Fact Sheet

ENVIRONMENTAL EFFECTS ON INTRUSION DETECTION SYSTEMS (IDSs)

PROBLEM

Exterior sensor systems used for intrusion detection are affected by their operating environment. They experience diurnal and seasonal variation in site conditions, as well as less predictable changes caused by storms. Winter conditions have sensor-specific impacts on IDS reliability. For example, when moist ground freezes, buried electromagnetic sensors have a higher probability of detection, but ground motion sensor systems become ineffective. Transitional periods can be particularly troublesome because of the frequency of change in a sensor's operating environment. Unless security personnel are aware of the dependence of sensor system reliability on site conditions, episodes of environmentally caused reduction in detection capability may go unnoticed—until an intruder passes undetected. If the variation in site conditions satisfies the alarm criteria of the sensor system, then the problem is numerous false alarms, which cause security personnel to lose confidence in the sensor system and perhaps fail to respond appropriately.

SOLUTION

Sensor system performance is optimized when environmental effects are accounted for during design and installation, and when operators are made aware of detection limitations resulting from weather and terrain effects. Probabilities of detection and false (nuisance) alarm rates must be expressed to security personnel as a function of the IDS's operating environment.

STATUS

With Army and Air Force funding, CRREL scientists have characterized the detection capability and alarm rates of radar, thermal infrared, seismic, buried electromagnetic, video, and fence-mounted IDSs under static and varying environmental conditions. Environmental characterization data have been correlated with system performance to identify site conditions that affect IDS detection capability and false alarm rate. These efforts have leveraged in-house expertise in meteorology, climatology, acoustics, electromagnetics, signal processing, and modeling of frost penetration. Results appear in numerous reports and publications, and summary guidelines have been prepared.

CRREL expertise can be applied to system development, trade-off studies, and performance testing, as well as to selection, installation, and operation of commercially available IDSs. CRREL field tests of intrusion detection systems also have been training exercises for Army Special Forces soldiers, who participated as high-threat intruders.

Special Forces soldiers attempting to breach security fence protected by vibration IDSs.

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